DOCUMENT RESUME

ED 145 327 CG 011 946

AUTHOR Sewald, Andrea M.; And Others
TITLE Learning What's Taught: Sex Differences in Instruction.
PUB DATE Apr 77
NOTE 38p.; Paper presented at the Annual Meeting of the American Educational Research Association (New York, N.Y., April 4-8, 1977) ; Best copy available

EDRS PRICE MF-$0.83 Plus Postage. HC Not Available from EDRS.
DESCRIPTORS *Academic Achievement; Elementary Education; *Elementary School Students; Grade 2; *Instruction; Interaction Process Analysis; Mathematics; *Performance Factors; Reading Achievement; Research Projects; *Sex Differences; Student Teacher Relationship; *Teacher Influence; *Teaching Procedures

ABSTRACT

Research indicates that boys perform better on mathematics tests while girls perform better on reading tests. An investigation of why boys' and girls' performance differs was made by coding teacher interactions with second grade students during reading and mathematics instruction. Results reveal that teachers: made relatively more academic contact with girls in reading and with boys in math; spent the same amount of time with boys and girls in both subjects; made more managerial contacts with boys in general; and, while there are no differences in initial abilities, sex differences were found in end-of-year achievement. (Author)

****
* Documents acquired by ERIC include many informal unpublished *
* materials not available from other sources. ERIC makes every effort *
* to obtain the best copy available. Nevertheless, items of marginal *
* reproducibility are often encountered and this affects the quality *
* of the microfiche and hardcopy reproductions ERIC makes available *
* via the ERIC Document Reproduction Service (EDRS). EDRS is not *
* responsible for the quality of the original document. Reproductions *
* supplied by EDRS are the best that can be made from the original. *
****

ED145327

Learning What's Taught:
Sex Differences in Instruction

Andrea Mar Seewald*
Gaea Leinhardt
Mary Engel

Learning Research and Development Center
University of Pittsburgh

BEST COPY AVAILABLE

Paper presented at the annual meeting of the American Educational Research Association, New York, April 1977, Section 23.18.

"PERMISSION TO REPRODUCE THIS MATERIAL IN MICROFICHE ONLY HAS BEEN GRANTED BY
Andrea Mar Seewald
TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC) AND USERS OF THE ERIC SYSTEM."

U S DEPARTMENT OF HEALTH, EDUCATION & WELFARE
NATIONAL INSTITUTE OF EDUCATION
THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY

*This work is part of an on-going series of studies that is collaborative in every respect. Order of authorship was determined by the toss of a coin.

CG 011846

Learning What's Taught: Sex Differences in Instruction[1]

Introduction

Educational researchers have begun to look with interest at why different groups of students achieve either more or less than others in presumably similar educational situations. While individual differences are expected, society does not expect differences in academic performance that are predictable by group membership, where group membership is based on a characteristic of birth rather than acquired skill. Stated slightly differently, there is an expectation that the observed variation within any group will be large in relation to the observed variation between groups. When differences in achievement do appear to be related to specific groups, it becomes a matter of some importance to attempt to identify the cause(s). When one or more causes of the disparity are identified, the potential to alter the situation becomes viable.

There are many studies that examine achievement differences among different races, religions, and ethnic backgrounds (e.g., Backman, 1972). The particular contrast is usually dependent on the specific concerns of the researchers and the current interests of society as a whole. The groups of interest in the present study are elementary school girls and boys; the grouping characteristic is gender. It is a generally held belief that in elementary

school, girls are stronger in verbal achievement and weaker in quantitative achievement than boys. The purpose of this paper is to empirically examine some possible causes for these differences in performance. The study is based on the assumption that the differences between American girls' and boys' academic performance are real. Two possible, but not exhaustive, hypotheses for the differences are: there is an inherent difference that affects performance and, as such, there is little that can be done by the educational community to lessen that difference; or, these differences are, in part, environmentally induced and, as such, changes are possible.

The argument for inherent differences in performance between groups uses the biological differences between the groups as its foundation. The argument is that there are known and observable differences in the physical, chemical, or genetic characteristics of girls and boys and that these differences <u>cause</u> performance differences. If one attributes performance differences to differences in brain lateralization, hormonal level, or heritability alone (e.g., Buffery & Gray, 1972), then there is little that can be done to alleviate the problem.

The argument for environmentally induced differences in performance focuses on other factors that can be, and have been, examined to track down observed differences in performance. For example, the home environment of different

groups of students is the focus of studies that demonstrate a relationship between home characteristics and performance differences (Maccoby & Jacklin, 1974). This line of inquiry takes the educational community neatly off the hook and out of the picture.

Some studies that take the educational community into account focus on classroom characteristics, looking at possible bias in curricular materials or subject matter (e.g., Stanchfield, 1973). The assumption underlying this line of inquiry is that the same input (e.g., text reader, history lesson) has different meanings and significance for members of different groups, which then translates into differing performance levels. Problems arise when this line of thought is followed to its logical end; that is, children should be taught only those things that they would be expected, by group membership, to be interested in or to value. This would suppress most educational opportunities for an individual to be different from the specific group to which s/he belongs.

Other educational research studies examine the possibility that different groups actually receive different treatments, even when those groups are in the same classroom. The focus of most of these studies is the teacher. This line of inquiry leads one to possible causes that can be altered if the difference is traceable to differential treatment. The current study takes the

position that it is more worthwhile to study manipulable characteristics in the educational environment than to study nonmanipulable ones outside of it, since our aim is to improve the quality of education for all groups. As teacher behavior is a major part of the instructional process, this study focuses on teacher verbal behavior used in the course of instruction.

The purpose of the paper is to document the differences, or lack of them, in the quantity and type of reading and mathematics instruction given that depend upon whether the student is a girl or a boy. Specifically, we examine the variations in academic <u>contacts</u> made by teachers to girls or boys depending upon what subject is being taught. We examine whether teachers spend differing amounts of <u>time</u> with girls or boys depending upon what subject is being taught. We also examine whether teachers make different <u>kinds</u> of contacts (i.e., cognitive versus managerial) to girls or boys depending upon what subject is being taught. And finally, we examine the differences in end-of-year performance between girls and boys in reading and mathematics.

<u>Background</u>

A tremendous amount of work has been conducted on potential causes of differences between groups and the specific causes of differences between girls' and boys'

academic performance. The work most relevant for the current study focuses on the following areas: (a) documentation of the differences or the lack of differences between girls and boys in intellectual functioning (general intelligence and academic achievement); (b) examination of the causes of observed differences, both biological and environmental; and, (c) examination of the methodology of studying classroom behavior as it relates to differential treatment of girls and boys.

Studies on intellectual functioning fall into two groups, those using general intelligence as the dependent variable and those using specific abilities. General intelligence usually refers to the score of an individual on a test alleged to measure the potential academic ability of that individual. No consistent sex differences have been found in general intelligence.[2] In studies using longitudinal data and in studies using differing subcultures in the United States, no significant differences that are attributable to the sex of the subjects have been reported when measuring the level of general intelligence or its rate of development (Bayley, 1956; Klaus & Gray, 1968; Schubert & Cropley, 1972). When studies are conducted that measure abilities closely related to general intelligence, such as problem solving and reasoning, girls and boys again do not appear to differ (Greenberger, O'Connor, & Sorensen, 1971; Daehler, 1972; McKinney, 1973). Out of 36 studies using measures of general intelligence that were described in a

review by Maccoby and Jacklin (1974), nine found girls or women to be superior, two found boys or men to be superior, and 25 found no differences due to sex.

Specific abilities, on the other hand, refer to an individual's achievement in a given subject matter area, such as reading. Studies that focus on specific abilities present a different picture than those focusing on general intelligence. Girls score higher than boys in reading skills and lower than boys on tests of mathematical abilities (Gates, 1961; Aiken, 1973). Large-scale studies that look at many areas of achievement across various age groups report similar results (Flanagan, Davis, Dailey, Shaycoft, Orr, Goldberg, & Neyman, 1964; Backman, 1972; National Assessment of Educational Progress, 1975). These differences in achievement, which appear as early as the preschool years, seem to increase with age -- dramatically so after adolescence (Gates, 1961; Hilton & Berglund, 1974).

Usually, two explanations are given for observed differences in achievement. One explanation is that differences in specific mental abilities are innate; the other is that these abilities are learned. Biological or innate causes of differences in performance include: heritability, development of brain lateralization, and hormonal level (e.g., Stafford, 1961; Broverman, Klaiber, Kobayashi, & Vogel, 1975; Buffery & Gray, 1972; Dalton,

1968). Other researchers, however, have refuted the idea that innate characteristics alone result in performance differences between girls and boys (Stafford, 1972; Parlee, 1972; Baker & Ehrhardt, 1974).

The alternative explanation for observed differences is that these differences are learned and reinforced within the broad context of the culture. Some of these studies compare the achievement of girls and boys in other countries (e.g., Brimer, 1969; Johnson, 1973-74; Preston, 1962; Dunsdon & Fraser-Roberts, 1957), while others look at factors within the home or school environment that may lead to differential reinforcement of behaviors thought to affect achievement (Dwyer, 1973; Finn, 1972; Grusec & Brinker, 1972; Levy, 1972; Palardy, 1969; Peltier, 1968; Lynn, 1972; McCarthy, 1963). This set of studies implies that sex differences in achievement are learned and, therefore, changeable. Their supporting theories, however, are either so global in nature as to require complete societal change to obtain a behavioral one, or there is existing evidence that contradicts the theories (e.g., see Brophy & Good, 1974).

One area in which research has focused on more specific behavioral characteristics is teacher affect. In this group of studies, there are two main approaches: either the teacher's behavior is observed directly (e.g., Meyer & Thompson, 1963), or, students are asked to report their

perceptions of the teacher's behavior (e.g., McNeil, 1964; Davis & Slobodian, 1967). There have been three basic problems with this type of research. First, the link between teachers' communicated affect and achievement has not been established. Second, it is not clear which is more important, the student's perception of teacher affect, which might be inaccurate (Davis & Slobodian, 1967), or the affect that is measured by "neutral" observers. Third, styles of communicating affect vary so much across individuals and subcultures that it is a very difficult behavior to define and/or manipulate.

Still another line of research looks at the impact of teachers' expectations of students, either on the teachers' instructional behavior toward girls and boys (Good & Brophy, 1971) or on the achievement of the students (Palardy, 1969). In both of the studies cited, significant differences were found. If teachers' expectations influence their instructional behavior and student performance, we need to know how these expectations manifest themselves.

If any attempt at equalization of treatment is to be achieved, one needs to look for and find small chunks of behavior that are easily manipulable. For example, if a teacher's verbal behavior is different toward girls than toward boys, a simple solution may be found to equalize treatment. A few studies have been done that focus on observing teacher instructional behavior toward girls and

boys. Once again there are conflicting results. Some researchers found that girls received more instructional contacts (Biber, Miller, & Dyer, 1972), others report that boys received more contacts (Sears & Feldman, 1966), while still others found no significant difference in the teachers' treatment of girls and boys (Good & Brophy, 1971).

The present study examines one possible reason that girls and boys differ in academic performance in reading and mathematics. The main hypothesis is that teachers teach girls relatively less mathematics and more reading than they teach boys.

Data Source

The Learning Research and Development Center (LRDC) is one of 22 Follow Through (FT) sponsors and implements its individualized reading and mathematics instructional programs across the country. In order to monitor the implementation of the programs, data on student performance and classroom practices have been collected in the fall and in the spring since 1971 (Leinhardt, 1976). The current study used the 1974-75 data on second grade classrooms. Student performance data consisted of the Lorge-Thorndike Cognitive Abilities Tests (CAT) (Thorndike, Hagen, & Lorge, 1968) administered in the fall; the Metropolitan Achievement Test (MAT) (Durost, Bixler , Wrightston, Prescott, & Balow, 1970) administered in the spring; and

progress data, which consist of the number of units of each curriculum completed at the end of the year.

Data on teacher instructional behaviors were obtained from videotapes of teachers engaged in reading and mathematics instruction. Forty-nine teachers were videotaped in the fall and again in the spring of the 1974-1975 school year. For this study, spring tapes made in March, 1975, were used. Sixteen of these tapes were deleted from analysis due to one or more of the following reasons: no student performance data were available; the teacher was male (since only two of the 49 teachers were male, they were eliminated from the analyses); or, the teacher used other than an individualized instructional approach (e.g., small groups) in either reading or mathematics. Class rosters were used to determine the distribution of girls and boys in each classroom.

Because LRDC's instructional programs are individualized, the task of looking at differences in how teachers interact with students was much easier than if the classrooms had been traditional ones. In an individualized setting, the teacher usually interacts with one child at a time. The teacher travels around the room and contacts students to tutor them, check their work, or monitor their progress. The videotape camera followed the teacher, who was the only one in the room wearing a microphone. This allowed the videotape coders to note, with relative ease,

the length, type, and number of contacts made to students according to sex.

Methods

Coding

In order to gain further insight into differences in student achievement, it was necessary to develop an easily understandable and systematic method of observing teacher instructional behavior while monitoring the sex of the student to whom that behavior was directed, as well as the subject area in which it occurred.

An observational coding scheme was developed, starting with one previously used to assess classroom process data (Leinhardt, 1976) and revising it to meet the needs of the present study. Each teacher interaction with an individual child was coded. The sex of the child was noted and the appropriate categories were marked as they occurred. Each interaction was timed and a decision was made as to the major focus of the interaction in terms of the categories used. The seven categories of teacher verbal behavior included: cognitive statements (CS), cognitive questions (CQ), management statements (MS), management questions (MQ), other statements (O), errors, and checking.[3] Figure 1 is a sample of the observation coding sheet used.

Insert Figure 1 about here

These categories can be viewed as belonging to three basic aspects of teachers' verbal contacts with children: content, frequency, and duration. It is assumed that the more often a child receives cognitively focused contacts from the teacher, the more likely it is that the child will learn the relevant academic material. Managerial contacts, on the other hand, are both symptomatic of a situation in which students either cannot or will not function without continuous teacher guidance, and indicate that the teacher is caught up in behavioral or procedural instructions rather than academic ones. It is assumed that the duration of contacts is not of primary importance for achievement. That is, we do not feel that length of contact could make up for frequency. This assumption has been supported by previous research (Leinhardt, 1976; Scott & Bushell, 1974) and is based on the view that in most cases a teacher ends up ignoring other students when s/he is involved in extended interactions with a single student. The benefit to the single student does not outweigh the loss to the remaining ones.

After summarizing each teacher's behavior in one subject area, a percentage of the total number of interactions of a certain type was calculated for girls and for boys. For example, in the cognitive statement category, if there were a total of 10 CSs, three to boys and seven to girls, the corresponding percentages would be 30% for boys and 70% for girls. These are the percentages yielded for observed interactions.

The rosters for each classroom were used to determine a measure of expected interactions. The number of girls and boys in each class was divided by the total number of students. That is, in a class of 25, with 10 boys and 15 girls, one would expect 40% of the interactons to be directed toward boys and 60% of the interactions to be directed toward girls, if the two groups received equal treatment.

The percentage of expected interactions was then subtracted from the percentage of observed interactions to yield a measure of the difference between expectation and observation. If the difference yielded a positive sign, it signified that that group received more of that type of interaction than would be expected if the groups received equal treatment. If the difference was negative, the reverse was true. In the example presented above, 70% was the observed percentage of CS interactions directed to girls. The expected percentage was 60%. Therefore, the

difference measure is +10.00, which means that girls are receiving more[4] cognitive statements (boys less) than would be expected.

For three of the variables (average duration of contacts, percent of time that is cognitive, and percent of contacts that are cognitive), it makes no sense to use the percent of girls or boys in the class as the expectancy. For these measures, the frequency and distribution of the category are accounted for in the construction of the measure itself. Therefore, if treatment were equal for girls and boys, the average duration of a teacher contact, for example, is expected to be equal regardless of the number of girls or boys in the classroom. The difference measures for these variables were determined by subtracting the boys' observed measure from the girls'. For example, if the average duration of contacts directed to girls was 43.25 seconds and the average duration of contacts directed to boys was 63.25 seconds, then the difference measure for girls was -20.00. This procedure was used for both the reading and mathematics instruction of all 33 teachers.

Expectations

We entered this study with four basic expectations regarding teachers' behaviors toward girls and boys.[5] We used these expectations to structure the analyses that were

carried out. First, we expected that teachers would give more cognitive information to girls than boys in reading and less in mathematics. Second, we expected that the amount of time spent teaching girls and boys would be similar in both reading and mathematics. Third, we expected that teachers would give more managerial information to boys than girls in both reading and mathematics. Finally, we expected the girls and boys in our sample to perform similarly on a test of general abilities, but we were uncertain as to how the girls and boys would perform on academic achievement tests. We were not certain if the math/reading split would hold in such an early grade level, where girls traditionally out-perform boys overall.

Statistics

The Wilcoxon matched-pairs signed-ranks test (Siegel, 1956) was used to estimate whether the differences between teacher behaviors in math and reading, with respect to the sex of the child, were significant. The Wilcoxon test was performed on eight measures from the original summaries. Variables that occurred infrequently were not analyzed ("checking", "other", and "errors"). The measures that were analyzed using the Wilcoxon test can be thought of as representing three variables: type of contacts, frequency of contacts, and time spent in contacts. The measures are:

1. Cognitive statements and questions
2. Management statements and questions
3. Total number of contacts
4. Total amount of time spent
5. Amount of cognitive time spent
6. Average duration of contacts
7. Percentage of total time spent that is cognitive
8. Percentage of total contacts that are cognitive

Using the mean score of the girls and the mean score of the boys for each classroom, performance measures were examined using an uncorrelated Student's t-test to determine whether there were any significant sex differences in initial abilities and correlated t-tests to determine whether there were performance differences in math and reading achievement or curricular progress..

Results

The Wilcoxon matched-pairs signed-ranks test, shown in Tables 1 and 2, was used to estimate if there was a difference in the observed behaviors toward girls and boys in reading and mathematics. The alpha level chosen was .05 for a one-tailed test. As expected, the two measures of the eight that dealt with cognitive information yielded significant differences: teachers direct more cognitive statements and questions to girls in reading than in math

(and vice versa for boys) ($p = .008$); the percentage of all contacts that are cognitive are higher for girls in reading than in math (and vice versa for boys) ($p = .024$). We also expected that boys receive more management contacts than girls regardless of which subject is being taught. The Wilcoxon matched-pairs signed-ranks test was performed on the difference between the percent of all observed management contacts made to boys and the percent of boys in the class. The difference was significant ($p = .013$), indicating that boys do receive more managerial contacts than girls regardless of subject area.

Insert Tables 1 and 2 about here

As expected, none of the measures of time spent yielded significant differences. These measures included: the total amount of interaction time, the amount of cognitive interaction time, the average duration of contacts, and the percentage of total time that was cognitive.

The final stage of analysis involved an examination of student performance data. Student initial abilities, as measured by the Lorge-Thorndike Cognitive Abilities Tests, were analyzed using Student's t-test. As shown in Table 3, no significant differences were found. End-of-year

achievement, measured by the Metropolitan Achievement Test, was analyzed by correlated t-tests using the means of the girls in a classroom and the means of the boys in a classroom as pairs. As shown in Table 4, significant differences were found in reading achievement, with girls out- performing boys ($p < .001$). No significant differences were found, however, in achievement in mathematics when boys and girls were compared. Similar results were found when progress data were analyzed ($p = .021$ for reading).

Insert Tables 3 and 4 about here

Discussion

The results of this study are consistent with the view that there are specific, identifiable teacher behaviors that affect the performance of students and that these behaviors are differentially applied depending on the sex of the student and the subject being taught. We have seen that teachers contact more girls to pass on cognitive information in reading than boys. This behavior may be due to their higher expectations for girls in reading or it may be that girls come into second grade being more verbal than boys. No matter what the cause of this behavior, however, there are two consequences. One is that girls perform

significantly better than boys in reading at the end of second grade in terms of achievement test scores and number of units progressed in the curriculum. Second, the stereotype of which subject a specific sex excels in is reinforced. The same logic holds for mathematics, albeit in the opposite direction.

The results of this study have increased our understanding of how girls and boys are treated in early instructional settings. They have also helped us to begin to formulate a model of teacher instruction. On the one hand, we can view the teacher as being an instructional resource to be utilized by all of the students in his or her classroom. On the other hand, we can consider the teacher to have a specific quantity of verbal resources to expend. The quantity varies from teacher to teacher, but, within the limits for each teacher, s/he can differentially allocate the resource to students and can decide on its content. The decision concerning to whom the contacts are directed should be based on whom the teacher wishes to teach; the decision of what the contact should contain should be based on what criterion is valued. Thus, if the teacher wishes to teach girls and boys equal amounts of some subject, s/he should try to allocate equal amounts of instruction; if the teacher wishes to teach mathematics, then the content of his or her verbal behavior should focus on mathematics rather than managerial information or personal discussions.

If it is desirable to improve the reading proficiency of boys and the mathematics proficiency of girls, the educational implications are clear. Teachers need to be made aware of and trained to alter, if necessary, their patterns of resource allocation in order to equalize the frequency of their cognitive contacts to boys and girls. Since we have seen that there is some time (approximately 22 percent) that the teacher focuses on other activities, such as management, it is possible to advocate increasing cognitive contacts to one sex while not decreasing cognitive contacts to the other.

These results do not eliminate biological explanations for sex differences in performance but they do show that there are manipulable behaviors that contribute to performance differences over which we can exert some control.

This study has helped us to move towards a paradigm for asking and answering questions about differential treatment of subgroups in an instructional setting. The paradigm involves: (a) the selection of criteria for group membership - in this case, gender; (b) the identification of the dimension of treatment - in this case, cognitive information; and, (c) an estimate of expected distribution of treatment that is then contrasted with observed treatment. The same paradigm can easily be used to study other groups, such as racial groups, and other treatments,

such as affective communication.

References

Aiken, L. R., Jr. Ability and creativity in math. Review of Educational Research, 1973, 43, 405-432.

Backman, M. E. Patterns of mental abilities: Ethnic, socioeconomic, and sex differences. American Educational Research Journal, 1972, 9, 1-12.

Baker, S. W., & Ehrhardt, A. A. Prenatal androgen, intelligence and cognitive sex differences. In R. C. Friedman, R. M. Richart, & R. L. Vande Wiele (Eds.), Sex differences in behavior. New York: John Wiley and Sons, 1974.

Bayley, N. Individual patterns of development. Child Development, 1956, 27, 45-74.

Biber, H., Miller, L., & Dyer, J. Feminization in preschool. Developmental Psychology, 1972, 7, 86.

Brimer, M. A. Sex differences in listening comprehension. Journal of Research and Development in Education, 1969, 3, 72-79.

Brophy, J. E., & Good, T. L. Teacher-student relationships: Causes and consequences. New York: Holt, Rinehart & Winston, 1974.

Broverman, D. M., Klaiber, E. L., Kobayashi, Y., & Vogel, W. Roles of activation and inhibition in sex differences in cognitive abilities. In R. K. Unger & F. L. Denmark (Eds.), Woman: Dependent or independent variable? New York: Psychological

Dimensions, Inc., 1975.

Buffery, A. W. H., & Gray, J. A. Sex differences in the development of spatial and linguistic skills. In C. Gunsted & D. C. Taylor (Eds.), Gender differences: Their ontogeny and significance. Baltimore: Williams & Wilkins, 1972.

Daehler, M. W. Developmental and experimental factors associated with inferential behavior. Journal of Experimental Child Psychology, 1972, 13, 324-338.

Dalton, K. Ante-natal progesterone and intelligence. British Journal of Psychiatry, 1968, 114, 1377-1382.

Davis, O. L., & Slobodian, J. J. Teacher behavior toward boys and girls during first grade reading instruction. American Educational Research Journal, 1967, 4, 261-269.

Dunsdon, M. I., & Fraser-Roberts, J. A. A study of the performance of 2,000 children on four vocabulary tests. British Journal of Statistical Psychology, 1957, 10, 1-16.

Durost, W. N., Bixler, H. H., Wrightston, J. W., Prescott, G. A., & Balow, I. H. Metropolitan Achievement Tests (Primary II/Form F). New York: Harcourt Brace Jovanovich, 1970.

Dwyer, C. A. Sex differences in reading: An evaluation and critique. Review of Educational Research, 1973, 43, 455-467.

Finn, J. D. Expectations and the educational environment.

Review of Educational Research, 1972, 42, 387-410.

Flanagan, J. C., Davis, F. B., Dailey, J. T., Shaycoft, M. F., Orr, D. B., Goldberg, I., & Neyman, C. A., Jr. The American highschool student. (Project Talent), University of Pittsburgh, Pittsburgh, Pennsylvania, 1964.

Gates, A. I. Sex differences in reading ability. Elementary School Journal, 1961, 61, 431-434.

Good, T. L., & Brophy, J. E. Questioned equality for grade one boys and girls. Reading Teacher, 1971, 25, 247-252.

Greenberger, E., O'Connor, J., & Sorensen, A. Personality, cognitive, and academic correlates of problem-solving flexibility. Developmental Psychology, 1971, 4, 416-424.

Grusec, J. E., & Brinker, D. B., Jr. Reinforcement for imitation as a social learning determinant with implications for sex role development. Journal of Personality and Social Psychology, 1972, 21, 149-158.

Hilton, T. L., & Berglund, G. W. Sex differences in mathematics achievement - a longitudinal study. Journal of Educational Research, 1974, 67, 231-237.

Johnson, D. D. Sex differences in reading across cultures. Reading Research Quarterly, 1973-74, 9, 67-86.

Klaus, R. A., & Gray, S. W. The early training project for disadvantaged children: A report after five years. Monographs of the Society in Child Development, 1968,

33, Serial 120.

Leinhardt, G. Program evaluation: An empirical study of individualized instruction. Pittsburgh: University of Pittsburgh, Learning Research and Development Center, 1976. (Publicaton No. 1976/5)

Levy, B. The school's role in the sex role stereotyping of girls: A feminist review of the literature. Feminist Studies, 1972, (Summer), 5-23.

Lynn, D. B. Determinants of intellectual growth in women. School Review, 1972, 80, 241-260.

Maccoby, E. E., & Jacklin, C. N. The psychology of sex differences. Palo Alto: Stanford University Press, 1974.

McCarthy, D. A. Sex differences in language development. In R. G. Kuhlen & G. G. Thompson (Eds.), Psychological studies of human development. New York: Appleton-Century-Crofts, 1963.

McKinney, J. D. Problem-solving strategies in impulsive and reflective second graders. Developmental Psychology, 1973, 8, 145.

McNeil, J. Programmed instruction versus visual classroom procedures in teaching boys to read. American Educational Research Journal, 1964, 1, 113-119.

Meyer, W., & Thompson, G. Teacher interactions with boys as contrasted with girls. In R. G. Kuhlen & G. G. Thompson (Eds), Psychological studies of human development. New York: Appleton-Century-Crofts, 1963.

National Assessment of Educational Progress. Male-female achievement in eight learning areas: A compilation of selected assessment results. Denver, Colorado: Education Commission of the States, 1975.

Palardy, J. M. What teachers believe, what children achieve. The Elementary School Journal, 1969, 69, 370-374.

Parlee, M. B. Comments on roles of activation and inhibition in sex differences in cognitive abilities by D. M. Broverman, E. L. Klaiber, Y. Kobayashi, and W. Vogel. Psychological Review, 1972, 79, 180-184.

Peltier, G. Sex differences in the school: Problem and proposed solution. Phi Delta Kappan, 1968, 50, 182-185.

Preston, R. Reading achievement of German and American children. School and Society, 1962, 90, 350-354.

Schubert, J., & Cropley, A. J. Verbal regulation of behavior and IQ in Canadian Indian and white children. Developmental Psychology, 1972, 7, 295-301.

Scott, J. W., & Bushell, D., Jr. The length of teacher contacts and students' off-task behavior. Journal of Applied Behavior Analysis, 1974, 7, 39-44.

Sears, P., & Feldman, D. Teacher interactions with boys and girls. The National Elementary Principal, 1966, 46, 30-35.

Siegel, S. Nonparametric statistics: For the behavioral sciences. New York: McGraw-Hill Book Company, Inc.,

1956.

Stafford, R. E. Sex differences in spatial visualization as evidence of sex-linked inheritance. Perceptual and Motor Skills, 1961, 13, 428.

Stafford, R. E. Hereditary and environmental components of quantitative reasoning. Review of Educational Research, 1972, 42, 183-201.

Stanchfield, J. Sex differences in learning to read. Bloomington, Indiana: Phi Delta Kappa Educational Foundation, 1973.

Thorndike, R., Hagen, E., & Lorge, I. Cognitive Abilities Tests (Primary I/Form I). Boston: Houghton Mifflin, 1968.

Footnotes

[1] The research reported herein was supported by the Learning Research and Development Center, supported in part by funds from the National Institute of Education (NIE), United States Department of Health, Education, and Welfare. The opinions expressed do not necessarily reflect the position or policy of NIE and no official endorsement should be inferred. The authors wish to acknowledge the assistance of James DiCostanzo, Kathy Engel, Connie Faddis, Sundari Krishnamurthy, and Louis Pingel.

[2] Of course, it may be that differences in general intelligence do not show up because math and reading skills are collapsed, or it may be that these tests are developed in such a way as to eliminate sex differences in particular.

[3] A cognitive statement is a content-related teacher verbal behavior that does not elicit a student response. The teacher may be giving specific directions on how to complete an assignment, explanations that convey cognitive information, or specific feedback on the work that the child has done. Cognitive questions, on the other hand, elicit a student response. The teacher may ask a direct cognitive question, request the child to perform a cognitive activity (e.g., "Count these blocks."), or prompt a child to respond. The two management categories are parallel in their distinction between statements and questions, but their focus is on controlling behavior. These verbalizations

concern procedural matters, discipline, or preparation for a task. The other category is reserved for statements or questions that deal with either personal or tangential information (e.g., "Have you ever had a dog like Spot?"). Errors refer to factual, uncorrected errors made by the teacher. For the checking category to be marked, the teacher must contact a child, be looking at or checking his/her work, and make no verbalizaton for the majority of the interaction time. After observing and coding each videotape, the teacher's verbal behavior was then summarized by: counting the number of interactions of each type made to boys; counting the number of interactions of each type made to girls; counting the total number of contacts made to each group; summing the total amount of time spent with each group; calculating the average duration of a contact for each group; calculating the amount of time spent with each group that was cognitive; calculating the percent of total time for each group that was cognitive; and calculating the percent of total contacts to each group that were cognitive.

In order to analyze the differences in math and reading instruction using the Wilcoxon test, we had to subtract the difference measure of girls in mathematics from the difference measure of girls in reading, that is, (Ro - Re)-(Mo-Me). (We would have gotten the same results had we used boys, but the direction would have been reversed.) Since Re and Me are identical for any given classroom (that

is, the percent of girls in the class), these expected values drop out. This was not the case when using the management measure, because our expectation was that it didn't matter what subject was being taught. The symbolic expression, therefore, was (Ro + Mo)=Xe where Xe is the percent of boys in the class and is equal to both Re and Me. Although the girls' expected values cancelled each other out when using this particular non-parametric test, the test still takes that expectation into account by virtue of the difference between reading and mathematics. That is, if girls receive 30% of the instruction in reading, one would expect that they also receive 30% of the instruction in mathematics. Even so, we feel that the idea of taking the percent of girls in the class into account is a valuable one, and that if one uses a different statistic, it is crucial to use some measure of expected value.

5 We use this word advisedly. We feel "hypotheses" implies a more advanced stage of theory development than we now are in, while "expectation" carries the possibility of bias that may in fact be present despite our efforts to avoid it.

Table 1
Wilcoxon Matched-Pairs Signed-Ranks Test
on the Difference in CS+CQ toward Girls
between Reading and Math Contacts

Teacher	Read	Math	d	Rank of d	Rank with less frequent sign
1	- 4.17	+ 4.16	- 8.33	11	11
2	+20.84	-12.50	+33.34	30	
3	+14.50	- 2.17	+16.67	17.5	
4	-56.00	+15.43	-71.43	33	33
5	+40.91	-25.00	+65.91	32	
6	0.00	-16.67	+16.67	17.5	
7	-11.28	-22.97	+11.69	14	
8	0.00	-25.00	+25.00	28	
9	+32.77	+ 2.62	+30.15	29	
10	+ 4.76	- 2.81	+ 7.57	10	
11	+21.85	+ 1.07	+20.78	22	
12	-25.30	- 1.17	-24.13	27	27
13	- .66	-10.22	+ 9.56	13	
14	+ 7.95	+ 6.62	+ 1.33	2	
15	+ 2.67	0.00	+ 2.67	3	
16	+12.88	- 4.27	+17.15	20	
17	- 6.35	-10.39	+ 4.04	4.5	
18	- 2.38	- 1.68	- .70	1	1
19	+12.04	+16.98	- 4.04	4.5	4.5
20	+ 7.14	- 9.53	+16.67	17.5	
21	- 2.50	- 7.95	+ 5.45	8	
22	+11.66	-10.96	+22.62	25	
23	+ 3.72	+12.50	- 8.78	12	12
24	- 8.33	+14.17	-22.50	24	24
25	+12.70	- 5.98	+18.68	21	
26	+17.05	- 3.78	+20.83	23	
27	+ 1.22	-22.37	+23.59	26	
28	-13.10	- 8.34	- 4.76	7	7
29	-14.50	- 7.83	- 6.67	9	9
30	+12.50	-25.60	+38.10	31	
31	+ 6.52	+ 1.97	+ 4.55	6	
32	-25.00	- 8.33	-16.67	17.5	17.5
33	+ 6.52	- 8.19	+14.71	15	
z = -2.40	p = .0082(one-tailed)				T = 146

Table 2
Wilcoxon Matched-Pairs Signed-Ranks Test
on the Difference in MS+MQ toward Boys
between Observed and Expected Contacts

Teacher	Read + Math Observed	Expected	d	Rank of d	Rank with less frequent sign
1	50.00	70.83	-20.83	20	20
2	66.67	54.17	+12.50	16	
3	60.00	47.83	+12.17	15	
4	50.00	44.00	+ 6.00	7	
5	80.00	50.00	+30.00	28	
6	41.18	50.00	- 8.82	10	10
7	60.00	31.58	+28.42	26	
8	60.00	50.00	+10.00	12	
9	12.50	47.06	-34.56	29	29
10	90.91	61.90	+29.01	27	
11	57.14	64.71	- 7.57	9	9
12	56.10	56.52	- .42	2	2
13	36.00	36.84	- .84	3	3
14	34.78	34.62	+ .16	1	
15	42.86	36.00	+ 6.86	8	
16	76.47	54.55	+21.92	23	
17	50.00	71.43	-21.43	22	22
18	100.00	52.17	+47.83	32	
19	50.00	59.09	- 9.09	11	11
20	100.00	57.14	+42.86	30	
21	100.00	37.50	+62.50	33	
22	60.00	47.37	+12.63	17	
23	70.00	45.83	+24.17	24	
24	100.00	54.17	+45.83	31	
25	61.29	55.56	+ 5.73	6	
26	80.00	54.55	+25.45	25	
27	33.33	54.55	-21.22	21	21
28	68.75	58.33	+10.42	14	
29	33.33	52.17	-18.84	19	19
30	62.50	45.83	+16.67	18	
31	66.67	56.52	+10.15	13	
32	40.63	41.67	- 1.04	4	4
33	53.85	56.52	- 2.67	5	5

$z = -2.242$ $p = .0125$ (one-tailed) $T = 155$

Table 3

Student's t-Test
on Initial Abilities Measure

Measure	Mean	Standard Deviation	t-value	df	two-tail probability
Lorge-Thorndike CAT			1.22	64	.114
Boys	57.48	3.37			
Girls	56.42	3.68			

Table 4

Correlated t-Tests
on Performance Measures

Measure	Mean	Standard Deviation	t-value	df	one-tail probability
Read Progress			-2.12	31	.021
Boys	7.20	2.05			
Girls	7.72	1.88			
Math Progress			1.28	32	.105
Boys	9.36	2.92			
Girls	9.00	3.02			
Read Achievement			-3.63	32	<.001
Boys	49.47	9.95			
Girls	54.41	9.08			
Math Achievement			- .88	32	.192
Boys	58.13	9.74			
Girls	59.30	8.24			

Figure 1
Videotape Coding Sheet
Sex Differences in Instruction

B/G	CS	CQ	MS	MQ	Other	Error	Checking	Total interaction time	Time converted to seconds

Site _____ Subject _____

Teacher (sex) _____ Grade _____

Taping Date _____ Coder _____

Coding Date _____